CHAPTER V

CONCLUSION AND FUTURE DIRECTION

5.1 Conclusion

The NR-silica generated *in situ* composite is achieved by sol-gel process of TEOS in latex. Various amount of TEOS can be directly added into NR latex. A homogeneous dispersion of latex mixed with TEOS is obtained after stirring at ~700 rpm. Analysis of the composites using SEM reveals that the *in situ*-formed silica particles are evenly dispersed in the NR matrix. The size of a single silica particle in the composite having 10% *in situ* silica observed by TEM is 44 nm.

The two-level factorial design experimental method had demonstrated to be a very useful tool to study the influence of the factors on mechanical properties. In this work, three analyses were carried out; tensile modulus at 300% elongation, tensile strength and tear strength. Statistic analysis of the data showed that TEOS content and gelation time had a significant effect on mechanical properties. It is also found that the amount of ammonia present in the concentrated latex is enough to complete the sol-gel process of TEOS. A composite containing 19% of silica having tensile modulus at 300% elongation of 3.7 MPa, tensile strength of 24 MPa, and tear strength of 41 N/mm is obtained.

When comparing the mechanical properties of the composite with *in situ* silica to the one with mechanically-mixed silica, the former has a higher tensile modulus and tear strength than the latter.

5.2 Future Direction

- Develop a protocol to produce NR-silica composite with sulfur-free vulcanization for use in biomedical applications
- Develop a method that can increase the homogeneity of latex and TEOS in order to increase the added amount of TEOS and, thus, silica in the composite.